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Research Article

COMPARISON OF SEVOFLURANE AND ISOFLURANE ON HEMODYNAMICS AND RECOVERY CHARACTERISTICS IN GERIATRIC PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY

VISHALDEEP SINGH, PARMOD KUMAR, TRIPAT KAUR BINDRA, JAGJIT SINGH, SIMRIT KAUR, LALIT KUMAR GARG*

Department of Anaesthesia, Government Medical College, Patiala, Punjab, India.
***Corresponding author: Lalit Kumar Garg; Email: lalitgarg68@yahoo.co.in**

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ABSTRACT

Objective: The aim of the present study was to compare sevoflurane and isoflurane on hemodynamics and recovery characteristics in geriatric patients undergoing laparoscopic cholecystectomy (LC).

Methods: The prospective, comparative, and randomized study was conducted on a total of 80 patients aged above 60 years of either sex and American Society of Anesthesiologists physical status I and II who were scheduled for elective LC under general anesthesia in Government Medical College, Rajindra Hospital, Patiala.

Results: Patients were hemodynamically stable throughout the surgery in both the groups but the emergence and recovery were significantly faster in the sevoflurane group. The sevoflurane group showed a faster time to spontaneous breathing, time to eye-opening, response to verbal commands, extubation time, and early orientation of the patient.

Conclusion: Sevoflurane might be considered a useful alternative to isoflurane in providing anesthesia in laparoscopic cholecystectomies, especially in elderly patients where rapid emergence and recovery are very much desired along with stable hemodynamic parameters.

Keywords: Sevoflurane, Isoflurane, Hemodynamics, Geriatric patients, Laparoscopic cholecystectomy.

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INTRODUCTION

Ambulatory surgeries enable patients to resume oral intake within a few hours after surgery, to be ambulatory at discharge, to resume their daily activities, and even to go back home on the same day as the surgery. This provides great benefits to not only the patients but also health-care providers and hospitals. With an increasing use of minimal invasive procedures, a large variety of procedures are now being carried out as ambulatory surgeries; laparoscopic cholecystectomy (LC) is one such procedure. There is a very low incidence of major morbidity and mortality associated with ambulatory surgery [1] and there are several important advantages of ambulatory surgery when compared with inpatient surgeries, such as a lower rate of cancellations, and reductions in waiting times, hospital costs, and the risk of nosocomial infection [2].

Laparoscopy is widely used for various surgeries such as appendicectomy, cholecystectomy, and hernia. LC is a major advancement in the management of patients with symptomatic gallbladder disease and the technique has almost replaced open cholecystectomy when it comes to gallbladder surgeries. The advantages of laparoscopic surgery over traditional open cholecystectomy include shorter hospital stays, more rapid return to normal activities, less pain due to small limited incisions, and less post-operative ileus as compared to the traditional open cholecystectomy [3].

In the comparison of isoflurane and sevoflurane in anesthesia for daycare surgeries, it was concluded that both isoflurane and sevoflurane are suitable for daycare anesthesia. Sevoflurane has the advantage of less airway hyper-reactivity and quicker emergence and discharge from the post-anesthesia care unit (PACU). In some studies, it has been found that in comparison of sevoflurane and isoflurane, there was more hypotension and bradycardia with sevoflurane. Sevoflurane permitted emergence 2 min earlier than isoflurane [4]. The reason for prolonged recovery after LC can also be pain, nausea, and vomiting. In some studies, it has been found that certain inhalational agents increase the sensitivity to pain at low concentrations as present during emergence but relieve pain at higher concentrations [4].

Elderly patients comprise an ever-growing proportion of the population, particularly in developed countries. In geriatric patients, chronological age is not the same as the biological age and a great deal of variation can be seen in the health status of people at the same age. Life expectancy has increased due to improvements in health services and surgical techniques [5]. Anesthetic administration has been guided by the use of age-adjusted estimations of minimum alveolar concentrations (MAC), the concentration at which 50% of patients will not move in response to surgical incisions. Older patients require a lower MAC fraction to produce an equivalent effect [6].

The aim of the present study was to compare sevoflurane and isoflurane on hemodynamics and recovery characteristics in geriatric patients undergoing LC.

MATERIALS AND METHODS

The prospective, comparative, and randomized study was conducted on a total of 80 patients aged above 60 years of either sex and American Society of Anesthesiologists (ASA) physical status I and II after approval from the ethics committee and informed consent from each patient who was scheduled for elective LC under general anesthesia in Government Medical College, Rajindra Hospital, Patiala.

Therefore, 80 patients were randomly divided into two groups,
Group A: Maintenance of patients on isoflurane anesthesia.
Group B: Maintenance of patients on sevoflurane anesthesia.

All the patients were kept fasting overnight or for a minimum of 8 h and were given tablet ranitidine 150 mg and tablet etizolam 0.25 mg at 6 am on the day of surgery. The patient's consent and pre-anesthetic checkup were done.

In the operation theater, routine monitors were attached and baseline pulse rate, systolic and diastolic BP, mean arterial pressure, and saturation of peripheral oxygen{SpO_2}, O_2 were recorded. The intravenous line was secured with an 18G cannula, and ringer lactate was started.

All the patients were pre-medicated with an injection of glycopyrrolate (0.01 mg/kg), an injection of butrum (0.02–0.04 mg/kg), and an injection of loxicard (1.5 mg/kg) given on the operating table 5 min before induction of anesthesia. Induction was done with propofol 1.5–2.5 mg/kg till initial loss of verbal contact. After checking ventilation, intubation was done with an injection of vecuronium (0.1 mg/kg loading dose) and maintained on N_2O/O_2 (50%/50%) and isoflurane in group A and sevoflurane in group B. Injection vecuronium 0.01 mg/kg was given as a muscle relaxant as a maintenance dose. The volatile agents were given at one MAC, that is, 1.2% for isoflurane and 2% for sevoflurane, further increasing or decreasing by 0.5% for sevoflurane and 0.2% for isoflurane (0.5) MAC according to the clinical assessment of the depth of anesthesia. The concentration of inhalational anesthetic agents was subsequently changed to the maintenance dose, so as to maintain adequate depth of anesthesia, that is, to maintain the mean arterial pressure and heart rate within 20% of baseline.

At the end of the surgery, sevoflurane or isoflurane was discontinued as per group and the residual neuromuscular block was reversed with injection of neostigmine 40 ug/kg iv and injection glycopyrrolate 10 ug/kg iv. After adequate motor recovery and spontaneous breathing efforts, extubation was done after proper oropharyngeal suctioning.

All the observations were recorded by a separate coworker who was blinded to the agent used in the maintenance of general anesthesia (introduced at the end of surgery). The primary endpoint was to compare the recovery characteristics between the two groups. Recovery characteristics were recorded.

Statistical analysis

The data were entered, cleaned, and compiled. It was descriptively described, and wherever required appropriate statistical test was applied. The data were analyzed using IBM SPSS version 22. p=0.05 was taken as significant.

RESULTS

In our study, the groups were comparable in terms of gender and ASA status. The blood pressures between the two groups were compared. Heart rate was comparable in both groups most of the time interval but the results were statistically significant in group B at time intervals from 60 to 80 min (Fig. 1). Systolic blood pressure (SBP) reveals lower values in group B which were statistically significant to Group A (Fig. 2) from 30 to 80 min intervals. Diastolic blood pressure (DBP) in both the groups was comparable from start to 80 min (Fig. 2). Analysis reveals quicker time to spontaneous breathing in sevoflurane group with mean±SD 4.38±0.77min in group A and 2.33±0.80 min in group B whereas time to eye opening was 6.43±0.78 min in group A and 4.13±0.69 min in group B (Fig. 4).

The study also revealed a faster time to respond to verbal command in group B with mean±SD 8±0.73 min in group A and 6.15±0.74 min in group B, and time extubation with mean±SD of 10.20±0.88 min in group A and 7.98±0.80 min in group B. Orientation stated by asking the name of the patient was also faster in sevoflurane group B with 12.43±0.96 min in group A and 10.00±0.78 min in group B (Fig. 5).

The baseline mean heart rate was comparable in both groups. It was also comparable in both the groups at all time intervals (p=0.05) except at 25, 60, 65, 70, 75, and 80 min being lower in group B and p value was 0.035, 0.008, 0.004, 0.004, 0.006, and 0.006 at 25, 60, 65, 70, 75, and 80 min intervals showed that there was fall in the heart rate in group B than group A and the difference was statistically significant. ($p<0.05$) at above mentioned time intervals.

The baseline SBP in group A was 129.60±11.56 mmHg whereas it was 128.90±11.84 mmHg in group B and it was comparable in both the groups as $p>0.05$. SBP in group A and group B was comparable in both the groups except at 30, 35, 40, 45, 55, 60, 65, 70, 75, and 80 min intervals at which SBP was lower in group B than in group A and the difference in both the groups was statistically significant as the $p<0.05$ at above mentioned time intervals.

The baseline DBP in group A was 79.30±9.72 mmHg and in group B was 78.65±9.46 mmHg and it was comparable in both the groups as $p>0.05$. DBP in group A and group B was comparable in both the groups at all time intervals and the difference in both groups was statistically non-significant as the $p>0.05$.

Fig. 4a shows mean time from discontinuation of anesthesia delivery to time to spontaneous breathing was 4.38±0.77 min in group A whereas it was 2.33±0.80 min in group B being shorter in group B. The difference was statistically highly significant as $p<0.001$.

Fig. 4b shows time from discontinuation of anesthesia delivery to time of eye opening was 6.43±0.78 min in group A whereas it was

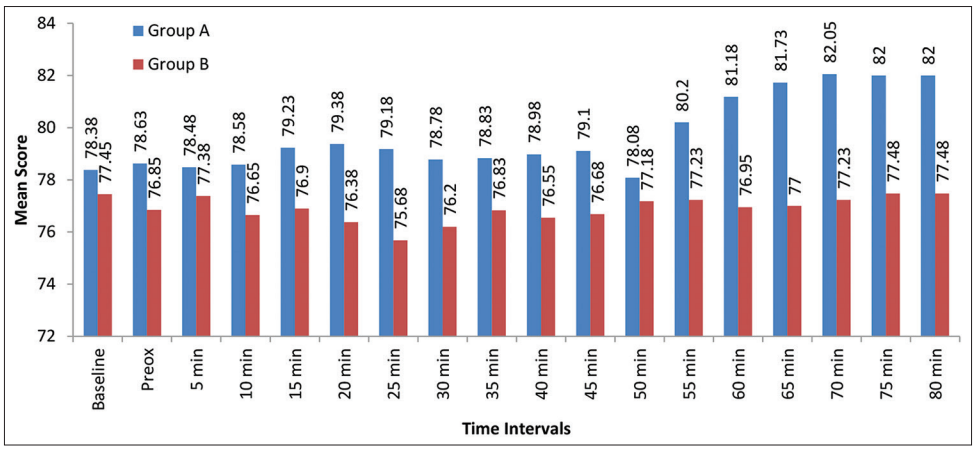

Fig. 1: Heart rate (bpm)

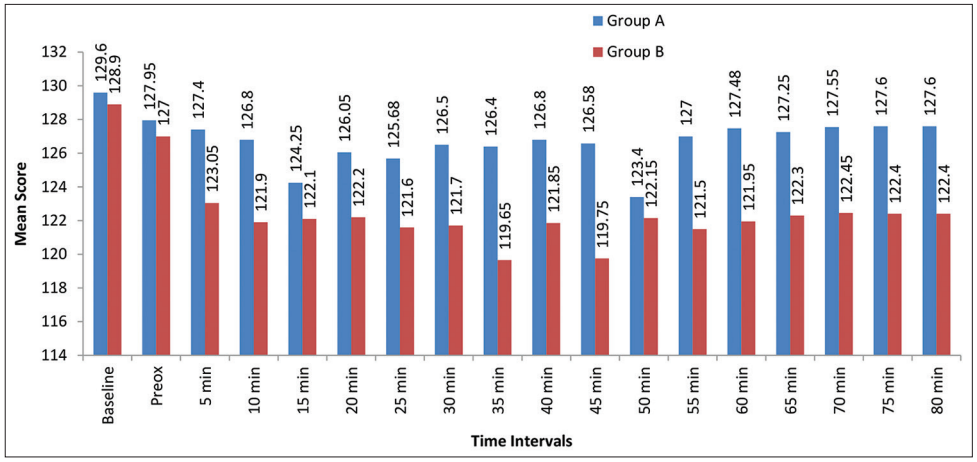

Fig. 2: Systolic blood pressure (mmHg) at min

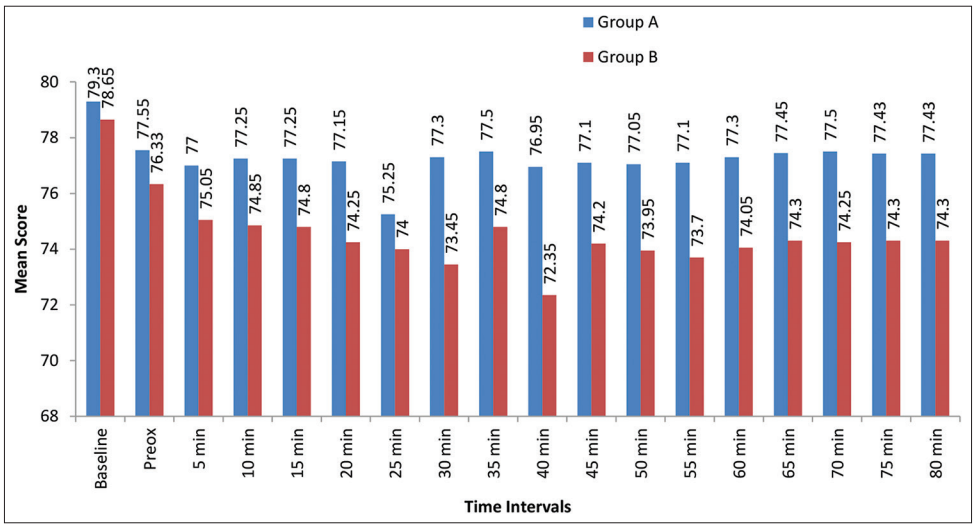

Fig. 3: Diastolic blood pressure (mmHg) at min

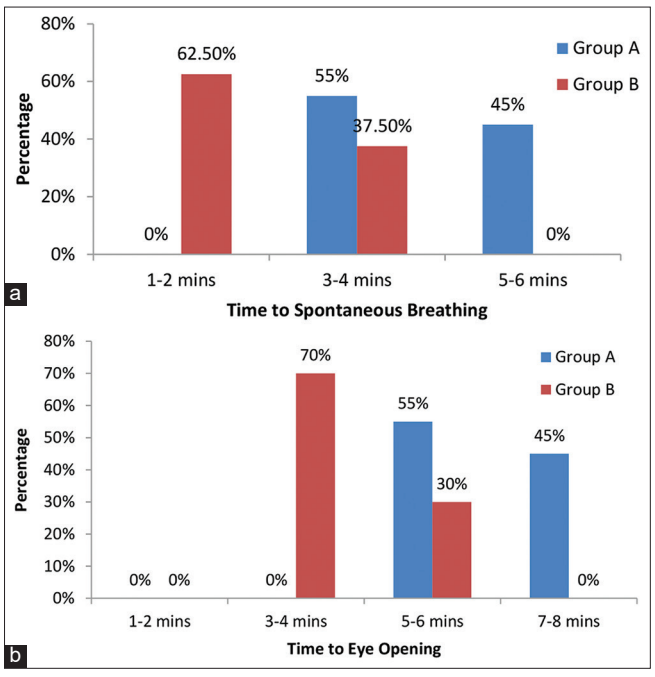

Fig. 4: Emergence (min). (a) Time to spontaneous breathing, (b) time to eye-opening

Table 1: Demographic data and relevant data

Demographic determinants	Group A (n=40)	Group B (n=40)	Significance
Age (mean±SD)	65.15±4.86	63.05 ±3.56	Significant
Gender (Female:Male)	32:8	33:7	Not significant
American Society of Anesthesiologists status (I:II)	25:15	27:13	Not significant

4.13±0.69 min in group B being shorter in group B. The difference was statistically highly significant as p<0.001. It shows that emergence time is shorter in group B.

Fig. 5a shows time from discontinuation of anesthesia delivery to time of motor response to verbal commands was 8.03±0.78 min in group A whereas it was 6.15±69 min in group B being shorter in group B. The difference was statistically highly significant as p<0.001.

Fig. 5b shows time from discontinuation of anesthesia delivery to extubation of the patient was 10.20±0.88 min in group A whereas it was 7.98±0.80 min in group B being shorter in group B. The difference was statistically highly significant as p<0.001.

Fig. 5c shows the time from discontinuation of anesthesia delivery to time to stating the name of the patient so as to check orientation

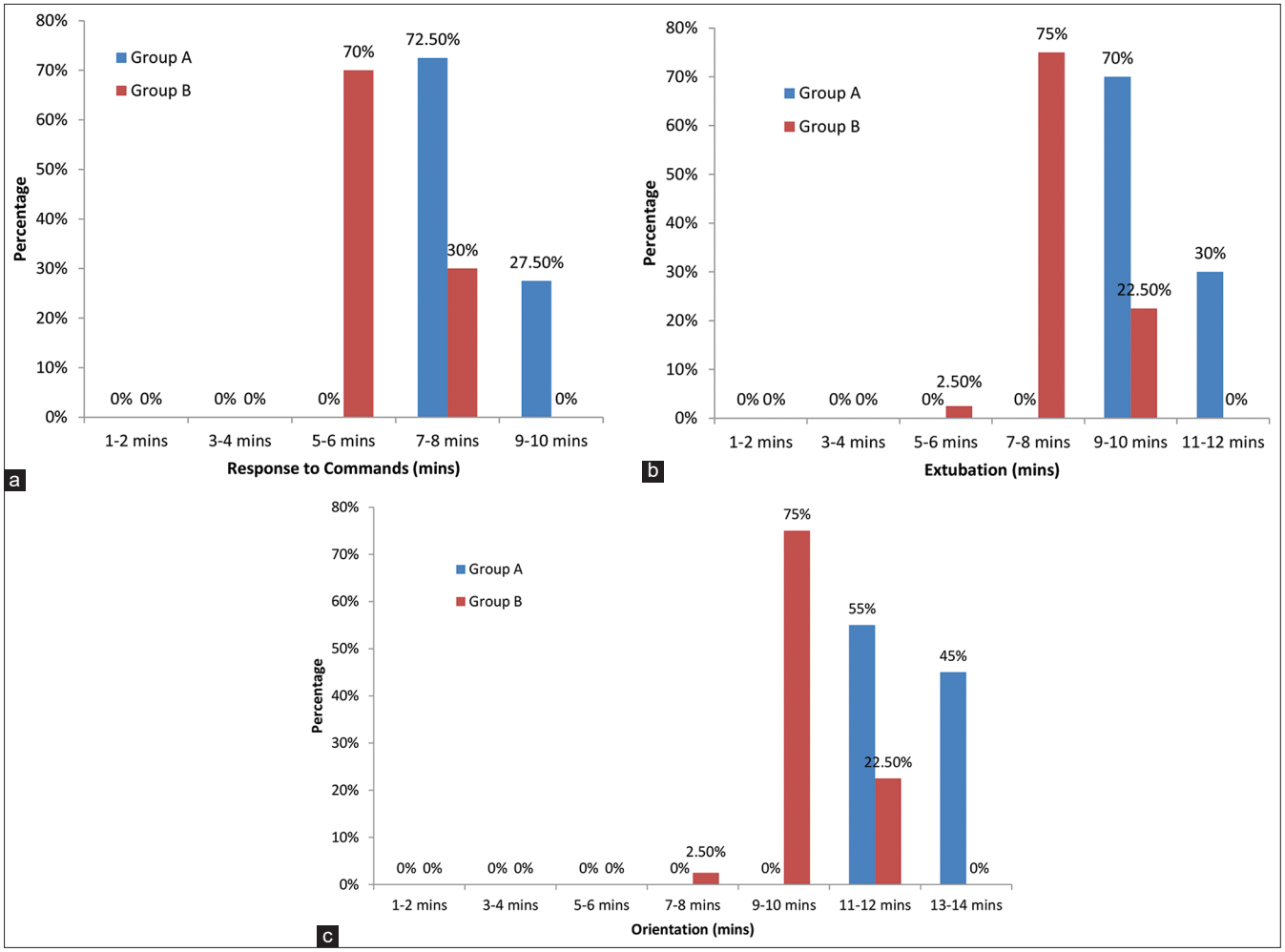

Fig. 5: (a) Time to response to commands (min), (b) extubation (min), (c) 6C orientation (min)

was 12.43±0.96 min in group A whereas it was 10.00±0.78 min in group B being lower in group B. The difference was statistically highly significant as p<0.001.

DISCUSSION

Recently, among multiple surgical techniques for the treatment of cholelithiasis and cholecystitis, LC is a method of choice [7]. Both neuraxial and general anesthesia are common anesthetic techniques in these patients. Anesthesia for laparoscopic surgery has various physiological changes associated with it, which may lead to hemodynamic instability, an increase in intra-abdominal pressure caused by pneumoperitoneum, patient position, and raising CO_2 saturation [8].

The mean age of patients in group A was 65.15±4.86 years and in group B was 63.05±3.56 years. Statistical analysis was done which showed that the difference in the mean age in both the groups was significant. The gender was equally distributed in both the groups, that is, in group A 80% are female and 20% are male and in group B 82.50% are female and 17.50% are male. In group A, 62.50% of patients were ASA I, and 37.50% were ASA II, and in group B, 67.50% were ASA I, and 32.50% were ASA physical status II. The difference in the ASA distribution of the two groups was statistically non-significant as p=0.191. The mean heart rate was comparable and not significant in both the groups throughout surgery except at 25, 60, 65, 70, 75, and 80 min intervals where it was significant. Clinically all patients were hemodynamically stable. This fall in mean arterial pressure in the isoflurane group may be because of its direct arterial vasodilator effect when it is administered during general anesthesia. Sevoflurane maintains cardiovascular stability better than isoflurane. On comparison of hemodynamic changes with sevoflurane and isoflurane anesthesia during laparoscopic surgery, there was a decrease in mean arterial pressure in the isoflurane group but there was no episode of significant hypotension which needed treatment in any of the groups and the patients remained hemodynamically stable throughout the surgery [9-11].

Emergence time, time to eye-opening, time to motor response to verbal commands, extubation time, and time to stating name was longer in group A than in group B. The results of the present study are in concordance with Smith *et al* [12] (1992), and Sahu *et al*. [13]. Smith *et al* [12] (1992) also stated that emergence and early recovery after maintenance of anesthesia with sevoflurane-N_2O was significantly faster than that after isoflurane-N_2O combination. Sahu *et al*. [13] stated that the use of sevoflurane and isoflurane in anesthesia in daycare surgeries using classical laryngeal mask airway and he concluded that both of the volatile anesthetics were suitable for the daycare surgeries whereas sevoflurane has the advantage of less airway hyperreactivity and quicker emergence and discharge from PACU. The results of the above studies were in accordance with our study. Contrary to our study, Katoh *et al*.[14] (1993) studied the influence of age on awakening concentrations of sevoflurane and isoflurane and found that the awakening concentrations of sevoflurane and isoflurane correlated significantly with age, therefore the ratio of MAC is fairly constant for both sevoflurane and isoflurane Reason being Laparoscopic surgery and Geriatric population in our study while Takasumi *et al*. conducted a study on General\Open surgery with the use of LMA in young age group. Contrary to our study, the study by Geng *et al*. [15] in 2017

suggested that the effect of sevoflurane and isoflurane on cognitive dysfunction following LC in elderly patients and concluded that the incidence of POCD was significantly reduced in patients administered sevoflurane as compared to isoflurane. This could be due to the use of fentanyl in induction and remifentanyl in the maintenance by Geng *et al*. [15] but we used Butrum during induction and N_2O during the maintenance period. While in our study, the effect on cognitive function was comparable in both groups in the immediate post-operative period.

CONCLUSION

Patients were hemodynamically stable throughout the surgery in both groups but the emergence and recovery were significantly faster in the sevoflurane group. Therefore, sevoflurane might be considered a useful alternative to isoflurane in providing anesthesia in laparoscopic cholecystectomies, especially in elderly patients where rapid emergence and recovery are very much desired along with stable hemodynamic parameters.

REFERENCES

1. Shnaider I, Chung F. Outcomes in day surgery. Curr Opin Anaesthesiol. 2006 Dec;19(6):622-9. doi: 10.1097/ACO.0b013e328010107e, PMID 17093366
2. Smith I, Cooke T, Jackson I, Fitzpatrick R. Rising to the challenges of achieving day surgery targets. Anaesthesia. 2006 Dec;61(12):1191-9. doi: 10.1111/j.1365-2044.2006.04875.x, PMID 17090241
3. Cunningham AJ, Brull SJ. Laparoscopic cholecystectomy and general anaesthesia: Anaesthetic implications. Anesth Analg. 1993;76(5):1120-33. doi: 10.1213/00000539-199305000-00035, PMID 8053989
4. Maheshwari K, Ahuja S, Mascha EJ, Cummings KC 3rd, Chahar P, Elsharkawy H, *et al*. Effect of sevoflurane versus isoflurane on emergence time and postanesthesia care unit length of stay: An alternating intervention trial. Anesth Analg. 2020 Feb 1;130(2):360-6. doi: 10.1213/ANE.0000000000004093, PMID 30882520
5. Juvin P, Servin F, Giraud O, Desmonts JM. Emergence of elderly patients from prolonged desflurane, isoflurane, or propofol anesthesia. Anesth Analg. 1997 Sep 1;85(3):647-51. doi: 10.1097/00000539-199709000-00029, PMID 9296424
6. Lobo SA, Ojeda J, Dua A, Singh K, Lopez J. Minimum Alveolar Concentration. Treasure Island, FL: StatPearls Publishing; 2004.
7. Longo MA, Cavalheiro BT, de Oliveira Filho GR. Laparoscopic cholecystectomy under neuraxial anesthesia compared with general anesthesia: Systematic review and meta-analyses. J Clin Anesth. 2017 Sep;41:48-54. doi: 10.1016/j.jclinane.2017.06.005, PMID 28802605
8. Hayden P, Cowman S. Anaesthesia for laparoscopic surgery. Contin Educ Anaesth Crit Care Pain. 2011 Oct 1;11(5):177-80. doi: 10.1093/bjaceaccp/mkr027
9. Eger EI 2nd. The pharmacology of isoflurane. Br J Anaesth. 1984 Jan 1;56 Suppl 1:71S-99. PMID 6391530
10. Kharasch ED. Biotransformation of sevoflurane. Anesth Analg. 1995 Dec 1;81(6 Suppl):S27-38. doi: 10.1097/00000539-199512001-00005
11. Jindal R, Kumra VP, Narani KK, Sood J. Comparison of maintenance and emergence characteristics after desflurane or sevoflurane in outpatient anaesthesia. Indian J Anaesth. 2011 Jan 1;55(1):36-42. doi: 10.4103/0019-5049.76604, PMID 21431051
12. Smith I, Ding Y, White PF. Comparison of induction, maintenance, and recovery characteristics of sevoflurane-N_2O and propofol-sevoflurane-N_2O with propofol-isoflurane-N2O anesthesia. Anesth Analg. 1992 Feb 1;74(2):253-9. doi: 10.1213/00000539-199202000-00015, PMID 1731547
13. Sahu DK, Kaul V, Parampill R. Comparison of isoflurane and sevoflurane in anaesthesia for day care surgeries using classical laryngeal mask airway. Indian J Anaesth. 2011 Jul 1;55(4):364-9. doi: 10.4103/0019-5049.84857, PMID 22013252
14. Katoh T, Suguro Y, Ikeda T, Kazama T, Ikeda K. Influence of age on awakening concentrations of sevoflurane and isoflurane. Anesth Analg. 1993 Feb 1;76(2):348-52. PMID 8424514
15. Geng YJ, Wu QH, Zhang RQ. Effect of propofol, sevoflurane, and isoflurane on postoperative cognitive dysfunction following laparoscopic cholecystectomy in elderly patients: A randomized controlled trial. J Clin Anesth. 2017 May 1;38:165-71. doi: 10.1016/j.jclinane.2017.02.007, PMID 28372661